

## CLAIMS

1. An optical clean-up filter with a desired spectral response, which comprises a plurality of tapered fiber filters concatenated in line on a single-mode optical fiber, said tapered fiber filters having specific wavelength response designs which closely match corresponding specific simulated responses resulting from a decomposition by means of a computer program or algorithm of the desired spectral response into individual specific simulated responses, whereby the in-line concatenation of said tapered fiber filters with responses of various specific designs produces the desired specific response in the clean-up filter.
2. An optical clean-up filter according to claim 1, in which the tapered fiber filters that are produced to match simulated responses with amplitudes of less than 3 dB have a tapered profile with a central beating region and a taper slope such as to minimize higher order modulation in the resulting responses.
3. ~~An optical clean-up filter according to claim 1, in which the tapered fiber filters that are produced to match simulated responses with amplitudes of more than 3 dB have a tapered profile with a central beating region and a coupling region at each end of said beating region with a non-adiabatic taper, thereby forming a tapered filter such as to minimize modulation in the resulting responses.~~

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4. An optical clean-up filter according to claims 1, 2 or 3 in which the plurality of tapered fiber filters are produced individually and then concatenated with one another by splicing them in-line on a single-mode optical fiber.

5. An optical clean-up filter according to claims 1, 2 or 3, in which the plurality of tapered fiber filters are produced directly in-line on a single-mode optical fiber.

6. A method of manufacturing an optical clean-up filter with a desired spectral response, which comprises:

(a) decomposing the desired spectral response into individual simulated responses using a suitable computer program or algorithm;

(b) manufacturing tapered fiber filters with parameters that closely match the individual simulated responses; and

(c) concatenating said tapered fiber filters on a single-mode fiber to produce the optical clean-up filter with a total response that closely matches the desired spectral response.

7. A method according to claim 6, in which the computer program for decomposing the desired spectral response into individual simulated responses of independent sine waves uses the following equation:

$$T = \beta [1 - \alpha \sin^2(\lambda - \lambda_0) \pi / \Lambda]$$

where:

T is the optical transmission of the filter,  
 $\alpha$  is the amplitude of the filter,  
 $\beta$  is the maximum transmission,

$\lambda$  is the wavelength,  
 $\lambda_0$  is the reference wavelength or  
center wavelength of the filter, and  
 $\Lambda$  is the wavelength period

- 5 and the product function for a plurality of such  
responses is calculated using the following equation:

$$F = T_1 \times T_2 \dots \dots \dots \times T_N$$

where:

- 10 F is the resulting filter function of the  
concatenation of the tapers that have the independent  
transmissions  $T_1$  to  $T_N$ .

8. A method according to claims 6 or 7, in which the  
tapered filters are manufactured separately to match  
individual simulated responses and then are concatenated  
15 ~~in-line by splicing them on a single-mode fiber.~~

9. A method according to claims 6 or 7, in which the  
tapered filters are produced in-line on the same single-  
mode filter to match the individual simulated responses.  
10. A method according to any one of claims 6 to 9, in  
20 which, upon their manufacture, the tapered fiber filters  
are bonded to a substrate and packaged in a protective  
packaging.